

IN THE CLAIMS

The claims are as follows:

1. (Previously Presented) A method of thin film deposition for integrated circuit fabrication, comprising:
 - providing a substrate;
 - treating the substrate with a plasma prior to forming a organosilicate layer, wherein the plasma is generated in a reaction chamber by applying an electric field to a gas mixture comprising molecular oxygen (O₂) and molecular hydrogen (H₂);
 - forming the organosilicate layer on the substrate; and
 - treating the organosilicate layer with the plasma.
4. (Previously Presented) The method of claim 1, wherein the gas mixture further comprises at least one gas selected from the group consisting of helium (He), argon (Ar), nitrogen (N₂), and combinations thereof.
5. (Previously Presented) The method of claim 1, wherein the electric field is provided by a radio frequency (RF) power.
6. (Previously Presented) The method of claim 5, wherein the RF power is within a range of about 1 watt/cm² to about 100 watts/cm².
7. (Previously Presented) The method of claim 1, wherein the reaction chamber is maintained at a pressure within a range of about 1 Torr to about 10 Torr.
8. (Previously Presented) The method of claim 1, wherein the plasma treatment is performed at a temperature within a range of about 50 °C to about 400 °C.

9. (Previously Presented) The method of claim 1, wherein the oxygen (O_2)/hydrogen (H_2) gases are provided to the reaction chamber at flow rates within a range of about 500 sccm to about 5,000 sccm.

10. (Previously Presented) The method of claim 4, wherein the at least one gas is provided to the reaction chamber at flow rates within a range of about 500 sccm to about 5,000 sccm.

11. (Previously Presented) The method of claim 1, wherein the organosilicate layer is formed by:

positioning the substrate in a deposition chamber;

providing a second gas mixture to the deposition chamber, wherein the second gas mixture comprises a silicon source, a carbon source, and an oxygen source; and

applying an electric field to the second gas mixture in the deposition chamber to form the carbon-containing silicate layer on the substrate.

12. (Previously Presented) The method of claim 11, wherein the silicon source and the carbon source comprise an organosilane compound having the general formula $Si_aC_bH_cO_d$, where a has a range between 1 and 2, b has a range between 1 and 10, c has a range between 6 and 30, and d has a range between 0 and 6.

13. (Previously Presented) The method of claim 12, wherein the organosilane compound is selected from the group consisting of methylsilane ($SiCH_3$), dimethylsilane (SiC_2H_6), trimethylsilane (SiC_3H_9), tetramethylsilane (SiC_4H_{12}), methoxysilane ($SiCH_3O$), dimethyldimethoxysilane ($SiC_4H_{12}O_2$), diethyldiethoxysilane ($SiC_6H_{16}O_2$), dimethyldiethoxysilane ($SiC_6H_{16}O_2$), diethyldimethoxysilane ($SiC_6H_{16}O_2$), hexamethyldisiloxane ($Si_2C_6H_{18}O$), bis(methylsilano)methane ($Si_2C_3H_{12}$), 1,2-bis(methylsilano)ethane ($Si_2C_4H_{14}$), and combinations thereof.

14. (Previously Presented) The method of claim 11, wherein the oxygen source is selected from the group consisting of nitrous oxide (N₂O), oxygen (O₂), ozone (O₃), carbon monoxide (CO), carbon dioxide (CO₂), and combinations thereof.
15. (Previously Presented) The method of claim 11, wherein the electric field applied to the second gas mixture in the deposition chamber is provided by a radio frequency (RF) power.
16. (Previously Presented) The method of claim 15, wherein the RF power is within a range of about 1 watt/cm² to about 500 watts/cm².
17. (Previously Presented) The method of claim 11, wherein the deposition chamber is maintained at a pressure between about 1 Torr to about 500 Torr.
18. (Previously Presented) The method of claim 12, wherein the organosilane compound is provided to the deposition chamber at a flow rate in a range of about 50 sccm to about 1,000 sccm.
19. (Previously Presented) The method of claim 11, wherein the oxygen source is provided to the deposition chamber at a flow rate in a range of about 10 sccm to about 200 sccm.
20. (Previously Presented) The method of claim 12, wherein the ratio of the oxygen source to the organosilane compound is about 1:1 to about 1:5.
21. (Previously Presented) The method of claim 11, wherein the deposition chamber is maintained at a temperature between about 50 °C to about 500 °C.
22. (Previously Presented) The method of claim 11, wherein the second gas mixture further comprises an inert gas.

23. (Previously Presented) The method of claim 22, wherein the inert gas is selected from the group consisting of helium (He), argon (Ar), neon (Ne), xenon (Xe), and combinations thereof.

24. (Previously Presented) The method of claim 22, wherein the inert gas is provided to the deposition chamber at a flow rate in a range of about 10 sccm to about 1,000 sccm.

74. (Previously Presented) A method of thin film deposition of an organosilicate layer, comprising:

positioning a substrate in a deposition chamber;

providing a gas mixture to the deposition chamber, wherein the gas mixture comprises a silicon source, a carbon source and an oxygen source;

applying an electric field to the gas mixture in the deposition chamber to form the organosilicate layer on the substrate; and

treating the organosilicate layer with a plasma, wherein the plasma is generated by applying a second electric field to a second gas mixture comprising molecular oxygen gas and molecular hydrogen gas.

75. (Previously Presented) The method of claim 74, wherein the substrate is treated with the plasma before deposition of the organosilicate.

76. (Previously Presented) The method of claim 74, wherein the gas mixture further comprises at least one gas elected from the group consisting of helium (He), argon (Ar), nitrogen (N₂) and combinations thereof.

77. (Previously Presented) The method of claim 76, wherein the electric field is provided by a radio frequency (RF) power.

78. (Previously Presented) The method of claim 77, wherein the RF power is within a range of about 1 watt/cm² to about 500 watts/cm².

79. (Previously Presented) The method of claim 78, wherein the reaction chamber is maintained at a pressure within a range of about 1 Torr to about 500 Torr.

80. (Previously Presented) The method of claim 74, wherein the plasma treatment is performed at a temperature within a range of about 50 °C to about 400 °C.

81. (Previously Presented) The method of claim 74, wherein the molecular oxygen (O₂) and molecular hydrogen (H₂) gases are provided to the reaction chamber at flow rates within a range from about 500 sccm to about 5,000 sccm.

82. (Previously Presented) The method of claim 76, wherein the at least one gas is provided to the reaction chamber with a flow rate at a range from about 500 sccm to about 5,000 sccm.

83. (Previously Presented) The method of claim 74, wherein the silicon source and the carbon source comprise an organosilane compound having the general formula Si_aC_bH_cO_d, where a has a range between 1 and 2, b has a range between 1 and 10, c has a range between 6 and 30 and d has a range between 0 and 6.

84. (Previously Presented) The method of claim 83, wherein the organosilane compound is selected from the group consisting of methylsilane (SiCH₃), dimethylsilane (SiC₂H₆), trimethylsilane (SiC₃H₉), tetramethylsilane (SiC₄H₁₀), methoxysilane (SiCH₃O), dimethyldimethoxysilane (SiC₄H₁₀O₂), diethyldiethoxysilane (SiC₈H₂₀O₂), dimethyldiethoxysilane (SiC₆H₁₆O₂), diethyldimethoxysilane (SiC₆H₁₆O₂), hexamethyldisiloxane (Si₂C₆H₁₈O), bis(methylsilano)methane (Si₂C₃H₁₂), 1,2-bis(methylsilano)ethane (Si₂C₄H₁₄) and combinations thereof.

85. (Previously Presented) The method of claim 84, wherein the oxygen source is selected from the group consisting of nitrous oxide (N₂O), oxygen (O₂), ozone (O₃), carbon monoxide (CO), carbon dioxide (CO₂) and combinations thereof.

86. (Previously Presented) The method of claim 74, wherein the second electric field applied to the gas mixture in the deposition chamber is provided by a radio frequency (RF) power.

87. (Previously Presented) The method of claim 86, wherein the RF power is within a range from about 1 watt/cm² to about 100 watts/cm².

88. (Previously Presented) The method of claim 87, wherein the deposition chamber is maintained at a pressure between about 1 Torr to about 10 Torr.

89. (Previously Presented) The method of claim 83, wherein the organosilane compound is provided to the deposition chamber at a flow rate in a range of about 50 sccm to about 1,000 sccm.

90. (Previously Presented) The method of claim 85, wherein the oxygen source is provided to the deposition chamber at a flow rate in a range of about 10 sccm to about 200 sccm.

91. (Previously Presented) The method of claim 90, wherein the ratio of the oxygen source to the organosilane compound is about 1:1 to about 1:5.

92. (Previously Presented) The method of claim 74, wherein the second gas mixture further comprises an inert gas.

93. (Previously Presented) The method of claim 92, wherein the deposition chamber is maintained at a temperature between about 50 °C to about 500 °C.

94. (Previously Presented) The method of claim 93, wherein the inert gas is selected from the group consisting of helium (He), argon (Ar), neon (Ne), xenon (Xe), and combinations thereof.

95. (Previously Presented) The method of claim 94, wherein the inert gas is provided to the deposition chamber at a flow rate in a range from about 10 sccm to about 1,000 sccm.

96. (Previously Presented) A method of thin film deposition of an organosilicate layer, comprising:

positioning a substrate in a deposition chamber;

depositing the organosilicate layer from a gas mixture, wherein the gas mixture comprises a silicon source, a carbon source and an oxygen source; and

treating the organosilicate layer with a plasma, wherein the plasma is generated by applying an electric field to a second gas mixture comprising molecular oxygen gas and molecular hydrogen gas.

97. (Previously Presented) The method of claim 96, wherein the substrate is treated with the plasma before deposition of the organosilicate layer.

98. (Previously Presented) The method of claim 96, wherein the gas mixture further comprises at least one gas elected from the group consisting of helium (He), argon (Ar), nitrogen (N₂) and combinations thereof.

99. (Previously Presented) The method of claim 98, wherein the electric field is provided by a radio frequency (RF) power.

100. (Previously Presented) The method of claim 99, wherein the RF power is within a range of about 1 watt/cm² to about 500 watts/cm².

101. (Previously Presented) The method of claim 98, wherein the reaction chamber is maintained at a pressure within a range of about 1 Torr to about 500 Torr.

102. (Previously Presented) The method of claim 98, wherein the plasma treatment is performed at a temperature within a range of about 50 °C to about 400 °C.

103. (Previously Presented) The method of claim 96, wherein the molecular oxygen (O₂) and molecular hydrogen (H₂) gases are provided to the reaction chamber at flow rates within a range from about 500 sccm to about 5,000 sccm.

104. (Previously Presented) The method of claim 98, wherein the at least one gas is provided to the reaction chamber with a flow rate at a range from about 500 sccm to about 5,000 sccm.

105. (Previously Presented) The method of claim 96, wherein the silicon source and the carbon source comprise an organosilane compound having the general formula Si_aC_bH_cO_d, where a has a range between 1 and 2, b has a range between 1 and 10, c has a range between 6 and 30 and d has a range between 0 and 6.

106. (Previously Presented) The method of claim 105, wherein the organosilane compound is selected from the group consisting of methylsilane (SiCH₃), dimethylsilane (SiC₂H₆), trimethylsilane (SiC₃H₉), tetramethylsilane (SiC₄H₁₀), methoxysilane (SiCH₃O), dimethyldimethoxysilane (SiC₄H₁₀O₂), diethyldiethoxysilane (SiC₈H₂₀O₂), dimethyldiethoxysilane (SiC₆H₁₆O₂), diethyldimethoxysilane (SiC₆H₁₆O₂), hexamethyldisiloxane (Si₂C₆H₁₈O), bis(methylsilano)methane (Si₂C₃H₁₂), 1,2-bis(methylsilano)ethane (Si₂C₄H₁₄) and combinations thereof.

107. (Previously Presented) The method of claim 105, wherein the oxygen source is selected from the group consisting of nitrous oxide (N₂O), oxygen (O₂), ozone (O₃), carbon monoxide (CO), carbon dioxide (CO₂) and combinations thereof.

108. (Previously Presented) The method of claim 107, wherein the oxygen source is provided to the deposition chamber at a flow rate in a range of about 10 sccm to about 200 sccm.

109. (Previously Presented) The method of claim 108, wherein the ratio of the oxygen source to the organosilane compound is about 1:1 to about 1:5.